California Air Resources Board

User Guide

California Department of Food and Agriculture
Alternative Manure Management Program

California Climate Investments

FINAL
March 10, 2022

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Section A. Introduction

For the California Department of Food and Agriculture (CDFA) Alternative Manure Management Program (AMMP), California Air Resources Board (CARB) staff developed the AMMP Benefits Calculator Tool and accompanying AMMP Quantification Methodology to provide guidance for estimating the greenhouse gas (GHG) emission reductions and selected co-benefits of each proposed project type. This User Guide provides instructions for using the AMMP Benefits Calculator Tool (Section B) and example projects (Section C).

The AMMP Benefits Calculator Tool and supporting AMMP Quantification Methodology are available for download at: www.arb.ca.gov/cci-resources. Methods and equations used in the AMMP Benefits Calculator Tool for estimating GHG emission reductions and air pollutant emission co-benefits are provided in the AMMP Quantification Methodology.

Updates

CARB staff periodically review each quantification methodology and benefits calculator tool to evaluate their effectiveness and update methodologies to make them more robust, user-friendly, and appropriate to the projects being quantified. CARB updated the AMMP Quantification Methodology from the previous version[1] to enhance the analysis and provide additional clarity. The changes include:

- Inclusion of vermifiltration and flocculant enhanced solid separation as new eligible practices;
- Modification of several inputs on "Project Data Inputs" tab to facilitate ease of use for applicants; and
- Updates to sloped screen solid and weeping wall separation factor.

Program Assistance

Applicants should use the following resources for additional questions and comments:

- Questions on this document should be sent to: GGRFProgram@arb.ca.gov.
- For more information on CARB's efforts to support implementation of California Climate Investments, see: www.arb.ca.gov/auctionproceeds.
- Questions pertaining to the AMMP should be sent to cdfa.oefi@cdfa.ca.gov.

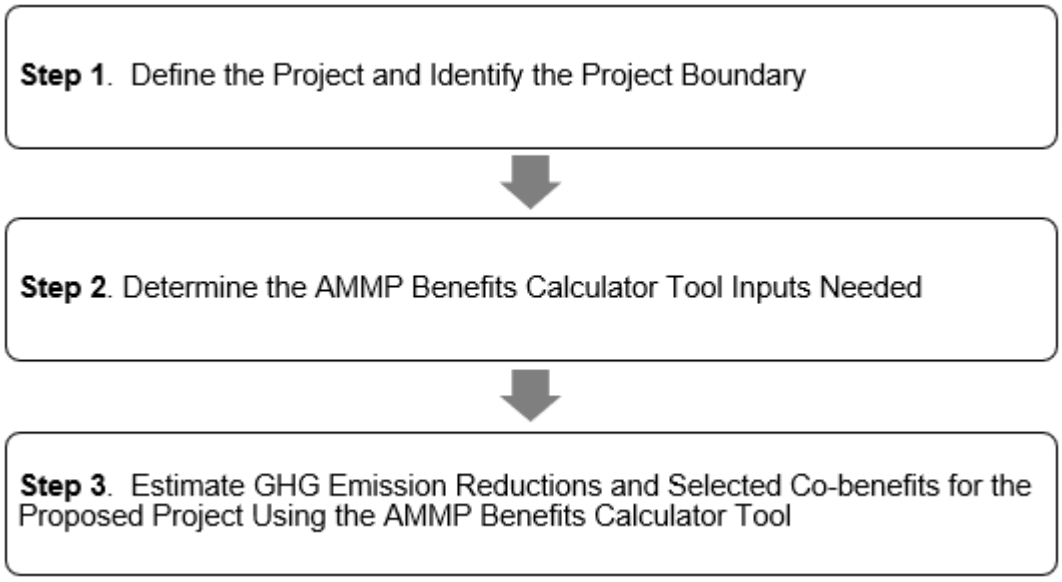
[1] Quantification Methodology for the California Department of Food and Agriculture Alternative Manure Management Program released March 27, 2018

Section B. Step-by-Step Guide

Overview

Applicants will follow the steps outlined in Figure 1 to estimate the GHG emission reductions and selected co-benefits from the proposed project. Detailed instructions for each step are provided on subsequent pages. Example projects showing how to estimate the GHG emission reductions and selected co-benefits from a project are included in Section C.

Figure 1. Steps to Estimating GHG Emission Reductions and Selected Co-benefits



Step 1: Define the Project and Identify the Project Boundary

Applicants must define the project by identifying eligible Project Types that apply to the project. Applicants may incorporate more than one Project Type, as appropriate, to quantify the GHG emission reductions and selected co-benefits. The Project Types identified will determine which sections of the AMMP Benefits Calculator Tool must be used in order to estimate the GHG emission reductions and selected co-benefits.

Project Types

AMMP supports several project types for which there are methods to quantify GHG emission reductions. **To be eligible, an applicant's current manure management practices must include the anaerobic decomposition of manure volatile solids stored in a lagoon or other predominantly liquid anaerobic environment.** Methane (CH_4) is produced when volatile manure solids are stored in wet, anaerobic conditions; consequently, conditions that lead to methane production must currently exist at a dairy or livestock operation in order for methane emission reductions to be achieved through an AMMP project.

Each AMMP project requesting GGRF funding must include at least one of the following project components that reduce baseline methane emissions:

1. **Pasture-based management** including (i) conversion of a non-pasture dairy or livestock operation to pasture-based management; or (ii) increasing the amount of time livestock spend at pasture at an existing pasture operation.

Note: All pasture-based management projects must currently manage/store some manure in wet/anaerobic conditions and introduce new practices that reduce the quantity of manure managed under such conditions.

2. **Alternative manure treatment and storage** including:
    a) Installation of a **compost bedded pack barn** that composts manure in situ;
    b) Installation of **slatted floor pit storage manure collection** that must be cleaned out at least monthly.

Note: Pit storage cleaned out at a frequency less than twelve times per year is not eligible since this allows conditions to become anaerobic. Vermicomposting systems must be paired with a solid separation device.

3. **Solid separation** of manure solids prior to entry into a wet/anaerobic environment (e.g., lagoon, settling pond, settling basin) at a dairy or livestock operation *in conjunction with one of the following practices (a) through (i):*
    a) **Open solar drying** of manure (manure is dried in a paved or unpaved open confinement area without any significant vegetative cover where accumulating manure may be removed periodically);
    b) **Closed solar drying** (drying of manure in enclosed environment);

c) **Forced evaporation with natural-gas fueled dryers**;
d) **Daily spread** (manure is routinely removed from a confinement facility and is applied to cropland or pasture within 24 hours of excretion);
e) **Solid storage** (storage of manure, typically for a period of several months, in unconfined piles or stacks);
f) **Composting in vessel** (composting in an enclosed vessel, with forced aeration and continuous mixing) or **in aerated static pile** (composting in piles with forced aeration but no mixing);
g) **Composting in intensive windrows** (with regular – at least daily – turning for mixing and aeration) or **passive windrows** (with infrequent turning for mixing and aeration); or
h) **Solid separation with aerated vermifiltration system.**

Note: Either the installation of a new solid separation system at a dairy or livestock operation that does not currently employ solid separation, or the installation of a new solid separation system with significantly higher separation efficiency than the existing solid separation technology may be eligible.

4. **Conversion from a flush to scrape manure collection system** *in conjunction with one of the practices (a) through (h) in the list above.*

While solid separation or conversion from flush to dry scrape manure collection can be a critical component an AMMP project, these practices are not considered to be stand-alone in isolation from how manure is stored and treated. In order to calculate GHG emissions and emission reductions, it is also necessary to identify how the separated or collected manure volatile solids will be treated and/or stored (e.g., open solar drying, composting in vessel). Storage or further treatment will always take place with separated or collected solids, and applicants are required to identify what this will be. The storage or further treatment of the collected solids produces methane to varying degrees, as determined by the Methane Conversion Factor (MCF) for each practice. Applicants should use the definitions provided in the Benefits Calculator Tool to determine which practice most closely describes how they will manage separated or scraped manure volatile solids. If an applicant's treatment/storage practice does not exactly match the definition of a listed practice, they will identify the most-closely related practice.

Manure management projects that include the installation of a biogas control system (digester) are not eligible for AMMP. These projects may be eligible for funding under the Dairy Digester Research and Development Program (DDRDP), also administered by CDFA.

Step 2: Determine the AMMP Benefits Calculator Tool Inputs Needed

Table 1 identifies the required data inputs needed to estimate the GHG emission reductions and selected co-benefits for the proposed project with the AMMP Benefits Calculator Tool by project type.

Required AMMP Benefits Calculator Tool Inputs for Eligible Project Types

General Information (Project Info Worksheet)

- Project Name;
- Application ID;
- Contact Name;
- Contact Phone Number;
- Contact Email;
- Date Calculator Completed;
- Total amount of AMMP GGRF funds requested from this solicitation to implement the project;
- Total amount of additional GGRF funds to implement the project (include GGRF funds previously awarded to the project by CDFA's AMMP Program or another California Climate Investments program, GGRF funds currently being requested from another California Climate Investments program, and GGRF funds the project plans to request in the future from CDFA's AMMP Program or another California Climate Investments program); and
- Total Funds ($).

Project Information (Project Data Inputs Worksheet)

- Project location (County);
- Identification of new manure management practice to be adopted;
- Baseline number of livestock by category (e.g., dairy cows in freestalls, dry cows, heifers, grow/finish swine, etc.) based on average of preceding 12 months data;
- Baseline (current) manure collection practices (e.g., flush or scrape collection);
- Baseline months livestock spend at pasture (if any);
- Baseline solid-separation and secondary solid separation, if any (e.g., stationary screen, vibrating screen);
- Baseline storage/treatment practice for separated solids (e.g., daily spread, composting);
- Specifications of milk produced, if applicable (lbs/cow/day, % fat, % true protein,% lactose);
- Baseline electricity and diesel fuel consumption associated with manure management activities by fuel type (MWh/yr, gallons/yr);
- Project (proposed) manure collection practices (e.g., flush or scrape collection);
- Project months livestock spend at pasture (if any);

- Project solid-separation and secondary solid separation, if any, (e.g., stationary screen, vibrating screen);
- Project flocculant treatment, if any;
- Estimated electricity and diesel fuel consumption associated with manure management activities by fuel type (MWh/yr, gallons/yr) after adoption of alternative manure management practices;
- Descriptive list of stationary and mobile CO_2 emission sources associated with manure management activities (baseline and project scenario).

Step 3: Estimate GHG Emission Reductions for the Proposed Project Using the AMMP Calculator Tool

Applicants must use the AMMP Benefits Calculator Tool to complete this step. The AMMP Benefits Calculator Tool can be downloaded from: www.arb.ca.gov/cci-resources.

Users should begin with the **Read Me** tab, which contains general information about the Benefits Calculator Tool. Key terms used throughout the AMMP Benefits Calculator Tool are defined in the **Definitions** tab. The **Documentation** tab provides details on the documentation requirements to allow the calculations to be reviewed and replicated.

The **Project Info** tab prompts users to enter general project information.

Project Name:	
Application ID:	
Contact Name:	
Contact Phone Number:	
Contact Email:	
Date Calculator Completed:	
Total AMMP GGRF Funds Requested ($):	
Other GGRF Leveraged Funds ($):	
Non-GGRF Leveraged Funds ($):	$ -
Total Funds ($):	$ -

The **Project Data Inputs** tab identifies inputs required by the user, generally requiring project-specific data or assumptions. Input and output fields are color coded:

- Green fields indicate direct user input is required.
- Blue fields are optional and user input is not required.
- Grey fields indicate output or calculation fields that are automatically populated based on user entries and the calculation methods.
- Yellow fields offer helpful hints or important tips to the user.
- Black fields are not applicable and no user input is necessary.

If an optional field is used, the applicant must submit additional supporting documentation (see the **Documentation** tab in the AMMP Benefits Calculator Tool).

On the Project Data Inputs tab, applicants first select the project location (county) from a drop-down list:

Project location (county)	

- Applicants select the relevant livestock categories from drop-down lists and enter the number of livestock by category based on the average of preceding 12 months data. These values are assumed to remain constant in both the baseline and project scenario. Note: Only livestock for which manure management will be affected by the AMMP project are included within the project boundary. Other livestock that are managed in other areas and for which manure management practices will not change may be excluded.

	Livestock Category	Animal Population
Livestock population by category. Note: Only livestock categories for which manure management will be affected in some way by the AMMP projected should be included. Other livestock categories that are managed in other areas and for which manure management practices will not change may be excluded.		

- **Dairy Applicant Information**: For dairy applicants only, applicants will input characteristics of milk produced. This includes the average percent fat, true protein and lactose of the produced milk, as well as average daily production per cow (lbs milk per cow per day).

Dairy Applicant Information	
Milk Fat (%)	
Milk true Protein (%)	
Milk Lactose (%)	
Milk Produced (lbs/cow/day)	

Applicants will next enter data to show the baseline manure management practices that are used on the dairy in the first column and the proposed project manure management practices on the right column (see below).

	Bseline manure management practices (current practices on the dairy or livestock operation)	Manure management practices after implementation of proposed AMMP project
New practice to be adopted		
Manure collection system		
For partial scrape systems, enter the percentage of manure that is flushed on annual basis		
Number of months livestock spend at pasture (if any)		
Primary Solid Separation		
Secondary Solid Separation (if any)		
Storage/treatment practice for separated/scraped solids		
Is a polymer used to increase separation efficiency?		
Electricity consumption associated with manure management (MWh/yr)		
Diesel fuel consumption associated with manure management (gallons/year)		

- **New practice to be adopted**: Applicants identify the new manure management practice to be adopted from a drop-down list. This is only applicable to the proposed project column and the baseline option is blacked out.
- **Manure collection system**: Applicants identify baseline and project manure collection practice (e.g., flush or scrape) from a drop-down list.
- **For partial scrape systems, enter the percentage of manure that is flushed on annual basis**: If applicants are using a partial scrape system, applicants should select the percentage of manure that is still sent to the flush system on an annual basis. This option is only available if the applicant selects "Partial scrape / partial flush / vacuum truck" in the "Manure Collection System" row. This option will be blacked out and unavailable for all other manure collection system options.
- **Number of months livestock spend at pasture (if any)**: Applicants identify the amount of time (in months) per year that livestock spend at pasture in the baseline and project scenarios, if any. This optional input may be left blank if not applicable.
- **Primary Solid Separation**: Applicants identify the baseline and project solid separation technology for flush system, if any. If there will be no solid separation, select "none" from the list.
- **Secondary Solid Separation (if any)**: Applicants identify the baseline and project secondary existing solid separation technology for flush system if there is more than one in place. This optional input may be left blank if not applicable.
- **Storage/treatment practice for separated/scraped solids**: Applicants identify the primary storage/treatment practice for separated or scraped manure solids. If more than one practice is utilized, applicants select the practice used to store/treat the greater quantity of manure solids.
    - Note: The field for "storage/treatment practice for separated/scraped solids" auto-populates in the project case
- **Is a flocculant used to increase separation efficiency?**: Select whether or not a flocculant will be used to increase the volatile solids separation efficiency of a solid separator.
- **Electricity consumption associated with manure management (MWh/yr) :**
    - For the baseline information, applicants enter electricity consumption related to manure management activities over the preceding 12 months (e.g., flush pumps, electric manure scrapers). These values may be estimated by the applicant based on available data.
    - For the project information, applicants enter estimated electricity consumption related to manure management activities after implementation of AMMP project (e.g., flush pumps, electric manure scrapers). These values may be estimated by the applicant based on how baseline electricity consumption is expected to change in the project scenario.
- **Diesel fuel consumption associated with manure management (gallons/year):**
    - For the baseline information, applicants enter diesel fuel consumption related to manure management activities (e.g., diesel tractors, scrapers, manure handling equipment, composting equipment, manure transport) based on energy consumption for manure management activities over the preceding 12 months.
    - For the project information, applicants enter estimated diesel fuel consumption related to manure management activities after implementation of AMMP project (e.g., diesel tractors, scrapers, manure handling equipment, composting equipment, manure transport. These values may be estimated by the applicant

based on how baseline diesel consumption is expected to change in the project scenario.

Description of Stationary and Mobile Sources associated with Manure Management Activities included in GHG Emission Calculations		
Source Description	Fuel Type	Change in emissions relative to Baseline

- In the final table, applicants list individual diesel combustion sources and identify whether each is a new source, or if diesel fuel consumption from an existing source is expected to increase, decrease or remain unchanged as a result of the AMMP project. Input 9 is not used directly in GHG calculations, but is required supplementary information.

The **GHG Summary** tab displays the estimated:

- **Total AMMP GHG Emission Reductions** summed over the 5 year quantification period (metric tons of carbon dioxide equivalent ($MTCO_2e$)).
- **Total GHG Emission Reductions** summed over the 5 year quantification period (metric tons of carbon dioxide equivalent ($MTCO_2e$)).
- **Total GHG Emission Reductions per Dollar of AMMP GGRF funds requested** is calculated as:

$$\frac{Total\ Project\ GHG\ Emission\ Reductions\ in\ Metric\ Tons\ of\ CO_2e}{AMMP\ GGRF\ Funds\ Requested\ (\$)}$$

- **Total Project GHG Emission Reductions per Dollar of Total GGRF funds requested** is calculated as:

$$\frac{Total\ Project\ GHG\ Emission\ Reductions\ in\ Metric\ Tons\ of\ CO_2e}{Total\ GGRF\ Funds\ Requested\ (\$)}$$

- **GHG Emission Reductions per metric ton of energy-corrected Milk Production** is calculated as:

$$\frac{GHG\ Emission\ Reductions\ in\ Metric\ Tons\ of\ CO_2e}{Energy\ Corrected\ Milk\ Production\ (ECM)\ over\ 5\ years\ in\ Metric\ Tons}$$

If applicable, this metric is intended to be used as a selection criteria by CDFA in the application scoring process. Milk production characteristics from the **Project Data Inputs** tab are used to calculate energy-corrected milk for livestock operations with lactating dairy cows. Using an energy-corrected milk production metric helps to account for differences in milk production rates and cow breeds among dairies.

- **GHG Emission Reductions per Animal** is calculated as:

$$\frac{GHG\ Emission\ Reductions\ in\ Metric\ Tons\ of\ CO_2e}{Total\ Number\ of\ Animals\ in\ Project\ Boundary}$$

  This metric is intended to be used by CDFA in the application scoring process. Only animals within the project boundary are included in this metric. It normalizes anticipated GHG reductions over 5 years by average livestock population within the project boundary, which is assumed to be constant over the life of the project.

The **Co-benefits Summary** tab displays the estimated:

- ROG emission estimates (lbs);
- NO_x emission estimates (lbs);
- $PM_{2.5}$ emission estimates (lbs);
- Diesel PM emission estimates (lbs);
- Compost production (dry tons); and
- Compost application area (acres);
- Fossil fuel use reductions (gallons); and
- Fuel and energy cost savings ($).

Section C. Example Project

Introduction

The following is a hypothetical project[2] to demonstrate how the AMMP Benefits Calculator Tool would be applied. This hypothetical project does not provide examples of the supporting documentation that is required of actual project applicants.

Example 1: Installation of Compost Bedded Pack Barn

Overview of the proposed project

The proposed AMMP project is requesting $250,000 dollars from CDFA to construct a new compost bedded pack barn for winter months at a dairy that employs primarily pasture-based management. Lactating dairy cows, dry cows, and heifers currently spend about 9 months of the year at pasture when weather conditions permit. The remainder of the year, they are housed in flushed freestalls. Installation of the compost pack barn will reduce manure solids from flushed freestalls that currently enter an anaerobic lagoon; however, manure deposited during milking will continue to be flushed into the lagoon. The characteristics of this project are:

- Located in Sonoma County;
- Installation of new compost bedded pack barn;
- $250,000 GGRF funds requested;
- 400 lactating dairy cows in freestalls, 100 dry cows and 100 heifers (grazing);
- Current practice involves flush system for freestalls and milking parlors;
- Flushed freestalls to be replaced by compost bedded pack barn;
- Dairy cows, dry cows and heifers are at pasture 9 months of the year;
- No solid separation in the baseline or project scenario;
- Average milk production of 55 lbs/cow/day, with 3.75% milk fat, 3% true protein, and 4.9% lactose;
- Diesel fuel used for manure collection and transport is expected to increase from approx. 600 gallons/yr to 1,200 gallons/yr (primarily from use of equipment in pack barn);
- 200 MWh electricity consumption in baseline scenario is expected to decrease to 150 MWh (primarily from decrease in electricity associated with pumps in the flush system).

[2] The hypothetical project has not undergone verification of any AMMP requirements; all assumptions about location type and project features are for AMMP Benefits Calculator Tool demonstration purposes only.

Methods to apply

Step 1: Identify the Project Boundary

The first step in quantifying this example project is to determine the Project Boundary. In order to do this, applicants should review included sources in Table 1 as it relates to their dairy or livestock operations. Applicants must be sure to identify any combustion sources associated with manure management operations prior to the adoption of new practices, identify how these emissions are expected to change as a result of the project, and identify if the project includes any new fossil-fuel combustion sources.

Methane emissions from manure volatile solids as well as CO_2 emissions associated with manure management support equipment and vehicles (both direct emissions from onsite combustion of fossil fuels and indirect emissions from electricity consumption) all fall within the project boundary both in the baseline and project scenarios.

In this example, there are diesel emissions associated with the collection of manure and support equipment; the quantity of diesel fuel combusted will increase as a result of diesel-fueled tractor rototillers in the pack barn and transport associated with material into and out of the pack barn. Electricity use is expected to decrease with decreased pumping of water in the flush system.

Step 2: Determine the AMMP Calculator Tool Inputs Needed

Step 2 of this Quantification Methodology requires applicants to enter project-specific information into the AMMP Calculator Tool. First, download and open the Calculator Tool from www.arb.ca.gov/cci-resources. The applicant begins by reading the "Read Me" and "Definitions" tab. Next, the applicant clicks on the "Project Info" and "Project Data Inputs" tab and enters required project information.

Below are a series of screenshots of the "Project Data Inputs" tab of the AMMP Calculator Tool. The fields highlighted green are required for all projects, while the fields highlighted blue may apply to some projects. Where input fields do not apply to the applicant's project, they may be left blank or a "0" value may be input.

For this example, applicants select "Sonoma" for the project location. Applicants then select "lactating dairy cows (freestalls)", "Cattle: dry cows", and "Cattle: heifers (grazing)" and 400, 100, and 100, respectively for animal population. Animal populations should be determined based on the average of the preceding 12 months.

Since the project includes lactating dairy cows, the applicant enters information regarding milk production (Average milk production of 55 lbs/cow/day, with 3.75% milk fat, 3% true protein, and 4.9% lactose).

Project location (county)	Sonoma

	Livestock Category	Animal Population
Livestock population by category. Note: Only livestock categories for which manure management will be affected in some way by the AMMP projected should be included. Other livestock categories that are managed in other areas and for which manure management practices will not change may be excluded.	Lactating Dairy Cows (freestall)	400
	Cattle: dry cows	100
	Cattle: heifers (grazing)	100

Dairy Applicant Information	
Milk Fat (%)	3.75%
Milk true Protein (%)	3.00%
Milk Lactose (%)	4.90%
Milk Produced (lbs/cow/day)	55

Baseline Scenario: Applicants next enter data for the current practices under "Baseline manure management practices (current practices on the dairy or livestock operation)".

The applicant then identifies the predominant baseline manure collection practice (Flush), the average number of months livestock will spend at pasture (9), baseline solid separation practice (none), and indicates if a flocculant is used to increase separation efficiency (No).

Finally, the applicant enters baseline electricity consumption (200 MWh/year) and diesel consumption (600 gallons/year).

Project Scenario: Just as with the baseline scenario, the applicant next enters information for the project scenario describing planned conditions and practices after the construction of a compost pack barn.

Note: For all projects, the livestock population is assumed to remain constant over the life of the project even if herd size may change.

The applicant then identifies the new practice to be adopted (2a- Installation of compost bedded pack barn), predominant manure collection system after project implementation (compost bedded pack barn), the average number of months livestock will spend at pasture (9), and the post-project solid separation practice(s) (none). The field identifying the predominant storage or treatment practice after project implementation auto-populates based on the new practice to be adopted.

Finally, the applicant enters estimated electricity (150 MWh/year) and diesel fuel (1,200 gallons) use after project implementation.

	Baseline manure management practices (current practices on the dairy or livestock operation)	Manure management practices after implementation of proposed AMMP project
New practice to be adopted		2a - Installation of compost bedded pack barn
Manure collection system	Flush	Compost bedded pack barn
For partial scrape systems, enter the percentage of manure that is flushed on annual basis		
Number of months livestock spend at pasture (if any)	9	9
Primary Stage Solid Separation	none	none
Second Stage Solid Separation (if any)		
Storage/treatment practice for separated/scraped solids	solid storage	compost bedded pack barn
Is a flocculant used to increase separation efficiency?	No	No
Electricity consumption associated with manure management (MWh/year)	200	150
Diesel fuel consumption associated with manure management (gallons/year)	600	1,200

The final table is used to list relevant CO_2 emission sources located at the bottom of the screen. This is intended to be a descriptive list to provide supplemental information, and is not used directly in the emissions calculations. In the AMMP Benefits Calculator Tool, diesel fuel use is reported as an aggregate number, but individual sources must still be listed at the bottom to identify which sources combusted each of the fuels identified. In this table, applicants also identify from a drop-down list whether each source is a new source (after adoption of alternative manure management practices), or whether there is expected to be an increase, decrease or no change in fuel consumption and GHG emissions as a result of the AMMP project. In this example, the applicant identifies that there will be an increase in diesel fuel use associated manure collection and transport and identifies tractor rototillers as a new sources.

Description of Stationary and Mobile Sources associated with Manure Management Activities included in GHG Emission Calculations

Source Description	Fuel Type	Change in emissions relative to Baseline
Manure collection and transport equipment	Diesel (Distillate No. 1 or 2, gal.)	Increase
Tractor rototillers for compost pack barn	Diesel (Distillate No. 1 or 2, gal.)	New source

Step 3: Estimate GHG Emission Reductions and Co-benefits Calculated using the AMMP Benefits Calculator Tool

After inputting all the required data, the applicant will click on the "GHG Summary" and "Co-benefits Summary" tabs of the worksheet. These tabs display the results calculated by the AMMP Benefits Calculator Tool.

The first grey rows of the "GHG Summary" tab contain the metrics required to be reported by the project applicant to CDFA. In this example, the proposed project is expected reduce GHG emissions by 2,719 $MTCO_2e$ over five years. This also represents 0.01088 $MTCO_2e$ per dollar requested from AMMP. It also represents 0.15 $MTCO_2e$ reduction per metric ton of milk produced (energy corrected), and 4.53 $MTCO_2e$ reduction per animal in the project boundary.

Project Information		
Project Name		
Total AMMP GGRF Funds Requested or Awarded ($)	$	250,000
Other GGRF Leveraged Funds ($)	$	-
Non-GGRF Leveraged Funds ($)	$	-
Total Funds ($)	$	250,000

GHG Summary		
Total AMMP GHG Emission Reductions (MTCO2e)		2,719
Total GHG Emission Reductions ($MTCO_2e$)		2,719
Total GHG Emission Reductions per Total AMMP GGRF Funds (MTCO2e/$)	$	0.01088
Total GHG Emission Reductions per Total Funds ($MTCO_2e$/$)	$	0.01088
GHG reduction per unit energy-corrected milk over 5 years (GHG/ECM)		0.15
GHG reduction per animal over 5 years (GHG/animal)		4.53

The "Co-benefits Summary" tab contains additional supplemental information. This project is expected to increase local emissions of ROG, NO_x, $PM_{2.5}$ and diesel PM as a result of anticipated increases in diesel fuel consumption of 600 gallons per year. There are also some indirect reductions in ROG, NO_x, and $PM_{2.5}$ emissions resulting from decreased electricity use. The project is also expected to result in an annual compost production of 285.4 dry tons, which may be applied to 12.3 acres of land.

Criteria and toxic air pollutant emission reductions (lbs over 5 years)

	ROG	NO_x	$PM_{2.5}$	Diesel PM
local	-65.1	-495.9	-17.4	-18.9
remote	5.1	32.0	8.0	0.0
total	**-60.0**	**-463.9**	**-9.4**	**-18.9**

Note: Positive values indicate emission reductons, while negative values indicate emission increases

Soil health co-benefits

Compost production	**285.4**	dry tons
Compost application area	**12.3**	Acres to be treated with compost soil ammendments

Note: Positive values indicate compost production, while negative values indicate reductions in compost production

Fossil fuel reductions (over 5 years)

Diesel gallons	**-3,000**

Note: Positive values indicate reductions in fossil fuel use, while negative values indicate increases in fossil fuel use

Fuel and energy cost savings (over 5 years)

$21,430

Example 2: Solid Separation with Composting (in vessel)

Overview of the proposed project

The proposed AMMP project is requesting $200,000 from CDFA to install an advanced centrifuge solid separation system at a dairy with an uncovered anaerobic lagoon to replace the simple stationary screen solid separator currently in use. This is expected to significantly enhance the percent of separated manure solids that are diverted from entering an anaerobic lagoon. Separated solids will be composted in vessel. The characteristics of this project are:

- Located in Tulare County;
- Solid separation with composting (in vessel);
- Current practice involves flush system and uncovered lagoon;
- Stationary screen solid separation in baseline scenario;
- Installation of new centrifuge solid separator in conjunction with a stationary screen in the project scenario;
- $200,000 GGRF funds requested;
- 1,500 lactating dairy cows in freestalls, 800 dry cows, and 400 heifers (on feed);
- Average milk production of 60 lbs/cow/day, with 4% milk fat, 3.1% true protein, and 4.7% lactose;
- Diesel fuel used for manure collection and transport is expected to decrease from approx. 2,000 gallons/yr to 1,500 gallons/yr;
- 400 MWh electricity consumption in baseline scenario is expected to increase to 550 MWh (due to increased electricity consumption associated with centrifuge solid separator).

Methods to apply

Step 1: Identify the Project Boundary

The first step in quantifying this example project is to determine the Project Boundary. In order to do this, applicants should review included sources in Table 1 as it relates to their dairy or livestock operations. Applicants must identify any combustion sources associated with manure management operations prior to the adoption of new practices, identify how these emissions are expected to change as a result of the project, and identify whether the project includes any new fossil-fuel combustion sources.

Methane emissions from manure volatile solids as well as CO_2 emissions associated with manure management support equipment and vehicles (both direct emissions from onsite combustion of fossil fuels and indirect emissions from electricity consumption) all fall within the project boundary both in the baseline and project scenarios.

In this example, there are diesel emissions associated with the collection and transport separated manure solids and compost; the quantity of diesel fuel combusted is anticipated to decrease as a result of less frequent cleaning out of the lagoon. Electricity use is expected to increase with the installation of the new solid separation system and with the increased volume of composted material.

Step 2: Determine the AMMP Calculator Tool Inputs Needed

Step 2 of this Quantification Methodology requires applicants to enter project-specific information into the AMMP Calculator Tool. First, download and open the Calculator Tool from www.arb.ca.gov/cci-resources. The applicant begins by reading the "Read Me" and "Definitions" tab. Next, the applicant clicks on the "Project Info" and "Project Data Inputs" tab and enters required project information.

Below are a series of screenshots of the "Project Data Inputs" tab of the AMMP Calculator Tool. The fields highlighted green are required for all projects, while the fields highlighted blue may apply to some projects. Where input fields do not apply to the applicant's project, they may be left blank or a "0" value may be input.

For this example, applicants select "Tulare" for the project location. Applicants then select "lactating dairy cows (freestalls)", "Cattle: dry cows", and "Cattle: heifers (on feed)" and 1,500, 800, and 400, respectively for animal population. Animal populations should be determined based on the average of the preceding 12 months.

Since the project includes lactating dairy cows, the applicant enters information regarding milk production (Average milk production of 60 lbs/cow/day, with 4% milk fat, 3.1% true protein, and 4.7% lactose).

Project location (county)	Tulare	
	Livestock Category	**Animal Population**
Livestock population by category. Note: Only livestock categories for which manure management will be affected in some way by the AMMP projected should be included. Other livestock categories that are managed in other areas and for which manure management practices will not change may be excluded.	Lactating Dairy Cows (freestall)	1,500
	Cattle: dry cows	800
	Cattle: heifers (on feed)	400

Dairy Applicant Information	
Milk Fat (%)	4.00%
Milk true Protein (%)	3.10%
Milk Lactose (%)	4.70%
Milk Produced (lbs/cow/day)	60

Baseline Scenario: Applicants next enter data for the current practices under "Baseline manure management practices (current practices on the dairy or livestock operation)".

The applicant then identifies the predominant baseline manure collection practice (Flush), the average number of months livestock will spend at pasture (0), baseline solid separation practice (stationary screen), storage or treatment practice for separated solids (composting – in vessel or aerated static pile), and indicates if a flocculant is used to increase separation efficiency (No).

Finally, the applicant enters baseline electricity consumption (400 MWh/year) and diesel consumption (2,000 gallons/year).

Project Scenario: Just as with the baseline scenario, the applicant next enters information for the project scenario describing planned conditions and practices after the installation of a centrifuge solid separator.

Note: For all projects, the livestock population is assumed to remain constant over the life of the project even if herd size may change.

The applicant then identifies the new practice to be adopted (3f - Solid separation with composting (in vessel or aerated static pile)), predominant manure collection system after project implementation (flush), the average number of months livestock will spend at pasture (0), storage or treatment practice for separated solids (composting – in vessel or aerated static pile), and the post-project solid separation practices (centrifuge and stationary screen). The field identifying the predominant storage or treatment practice after project implementation auto-populates based on the new practice to be adopted.

Finally, the applicant enters estimated electricity (550 MWh/year) and diesel fuel (1,500 gallons) use after project implementation.

	Baseline manure management practices (current practices on the dairy or livestock operation)	Manure management practices after implementation of proposed AMMP project
New practice to be adopted		3f - Solid separation with composting (in vessel or aerated static pile)
Manure collection system	Flush	Flush
For partial scrape systems, enter the percentage of manure that is flushed on annual basis		
Number of months livestock spend at pasture (if any)	0	0
Primary Stage Solid Separation	stationary screen	centrifuge
Second Stage Solid Separation (if any)		stationary screen
Storage/treatment practice for separated/scraped solids	composting - in vessel or aerated static pile	composting - in vessel or aerated static pile
Is a flocculant used to increase separation efficiency?	No	No
Electricity consumption associated with manure management (MWh/year)	400	550
Diesel fuel consumption associated with manure management (gallons/year)	2,000	1,500

The final table is used to list relevant CO_2 emission sources located at the bottom of the screen. This is intended to be a descriptive list to provide supplemental information and is not used directly in the emissions calculations. In the AMMP Benefits Calculator Tool, diesel fuel use is reported as an aggregate number, but individual sources must still be listed at the bottom to identify what sources combusted each of the fuels identified. In this table, applicants also identify from a drop-down list whether each source is a new source (after adoption of alternative manure management practices), or whether there is expected to be an increase, decrease or no change in fuel consumption and GHG emissions as a result of the AMMP project.

Description of Stationary and Mobile Sources associated with Manure Management Activities included in GHG Emission Calculations

Source Description	Fuel Type	Change in emissions relative to Baseline
Manure collection and transport equipment	Diesel (Distillate No. 1 or 2, gal.)	Decrease

Step 3: Estimate GHG Emission Reductions and Co-benefits Calculated using the AMMP Benefits Calculator Tool

After inputting all the required data, the applicant will click on the "GHG Summary" and "Co-benefits Summary" tabs of the worksheet. These tabs display the results calculated by the AMMP Benefits Calculator Tool.

The grey rows of the "GHG Summary" tab contain the metrics required to be reported by the project applicant to CDFA. In this example, the proposed project is expected reduce GHG emissions by 17,596 $MTCO_2e$ over five years. This also represents 0.08798 $MTCO_2e$ per dollar requested from AMMP. It also represents 0.23 $MTCO_2e$ reduction per metric ton of milk produced (energy corrected), and 6.52 $MTCO_2e$ reduction per animal in the project boundary.

Project Information		
Project Name		
Total AMMP GGRF Funds Requested or Awarded ($)	$	200,000
Other GGRF Leveraged Funds ($)	$	-
Non-GGRF Leveraged Funds ($)	$	-
Total Funds ($)	$	200,000

GHG Summary		
Total AMMP GHG Emission Reductions (MTCO2e)		17,596
Total GHG Emission Reductions ($MTCO_2e$)		17,596
Total GHG Emission Reductions per Total AMMP GGRF Funds (MTCO2e/$)	$	0.08798
Total GHG Emission Reductions per Total Funds ($MTCO_2e$/$)	$	0.08798
GHG reduction per unit energy-corrected milk over 5 years (GHG/ECM)		0.23
GHG reduction per animal over 5 years (GHG/animal)		6.52

The "Co-benefits Summary" tab contains additional supplemental information. This project is expected to decrease local emissions of ROG, NO_x, $PM_{2.5}$ and diesel PM as a result of anticipated decreased in diesel fuel consumption of 500 gallons per year. There are also some indirect increases in ROG, NO_x, and $PM_{2.5}$ emissions resulting from increased electricity use. The project is also expected to result in an annual compost production of 1,746.1 dry tons, which may be applied to 75.1 acres of land. Fossil fuel consumption is expected to decrease by 2,500 gallons, while net energy and fuel costs increase as a result of increased electricity consumption.

Criteria and toxic air pollutant emission reductions (lbs over 5 years)

	ROG	NO_x	$PM_{2.5}$	Diesel PM
local	54.3	413.3	14.5	15.8
remote	-15.3	-96.0	-24.1	0.0
total	**39.0**	**317.3**	**-9.6**	**15.8**

Note: Positive values indicate emission reductons, while negative values indicate emission increases

Soil health co-benefits

Compost production	**1,746.1**	dry tons
Compost application area	**75.1**	Acres to be treated with compost soil ammendments

Note: Positive values indicate compost production, while negative values indicate reductions in compost production

Fossil fuel reductions (over 5 years)

Diesel gallons	**2,500**

Note: Positive values indicate reductions in fossil fuel use, while negative values indicate increases in fossil fuel use

Fuel and energy cost savings (over 5 years)

-$89,250

Example 3: Partial conversion from Flush to Scrape Manure Collection with Open Solar Drying

Overview of the proposed project

The proposed AMMP project is requesting $750,000 dollars from CDFA to convert from a flush to dry scrape manure collection system with open solar drying 9 months of the year. The remaining months, freestalls will continue to be flushed. The characteristics of this project are:

- Located in Kern County;
- Current practice involves flush system and uncovered lagoon;
- Solid separation with stationary screen in the baseline scenario
    - Separated solids are stored outdoors to dry and periodically applied to land (dry lot);
- Proposed partial conversion to dry scrape manure collection system;
    - Open solar drying of scraped manure for 9 months of year (75% scrape / 25% flush);
    - Freestalls will be flushed during remainder of year;
- $750,000 GGRF requested;
- 1,500 lactating dairy cows in freestalls, 800 dry cows, and 400 heifers (on feed);
- Average milk production of 55 lbs/cow/day, with 4.1% milk fat, 3.2% true protein, and 4.5% lactose;
- Diesel fuel used for manure collection and transport is expected to increase from approx. 3,000 gallons/yr to 3,500 gallons/yr (primarily with scrape system and increased manure transport);
- 400 MWh electricity consumption in baseline scenario is expected to decrease to 250 MWh (primarily from decreased electricity associated with electric pumps in flush system).

Methods to apply

Step 1: Identify the Project Boundary

The first step in quantifying this example project is to determine the Project Boundary. In order to do this, applicants should review included sources in Table 1 as it relates to their dairy or livestock operations. Applicants must be sure to identify any combustion sources associated with manure management operations prior to the adoption of new practices, identify how these emissions are expected to change as a result of the project, and identify if the project includes any new fossil-fuel combustion sources.

Methane emissions from manure volatile solids as well as CO_2 emissions associated with manure management support equipment and vehicles (both direct emissions from onsite combustion of fossil fuels and indirect emissions from electricity consumption) all fall within the project boundary both in the baseline and project scenarios.

In this example, there are diesel emissions associated with the collection of manure and support equipment; the quantity of diesel fuel combusted is expected to increase as a result of scrape system equipment and manure transport. Electricity use is expected to decrease as a result of decreased pumping for flush water.

Step 2: Determine the AMMP Calculator Tool Inputs Needed

Step 2 of this Quantification Methodology requires applicants to enter project-specific information into the AMMP Calculator Tool. First, download and open the Calculator Tool from www.arb.ca.gov/cci-resources. The applicant begins by reading the "Read Me" and "Definitions" tab. Next, the applicant clicks on the "Project Info" and "Project Data Inputs" tab and enters required project information.

Below are a series of screenshots of the "Project Data Inputs" tab of the AMMP Calculator Tool. The fields highlighted green are required for all projects, while the fields highlighted blue may apply to some projects. Where input fields do not apply to the applicant's project, they may be left blank or a "0" value may be input.

For this example, applicants select "Kern" for the project location. Applicants then select "lactating dairy cows (freestalls)", "Cattle: dry cows", and "Cattle: heifers (on feed)" and 1,500, 800, and 400, respectively, for animal population. Animal populations should be determined based on the average of the preceding 12 months.

Since the project includes lactating dairy cows, the applicant enters information regarding milk production (Average milk production of 55 lbs/cow/day, with 4.1% milk fat, 3.2% true protein, and 4.5% lactose).

Project location (county)	Kern	
	Livestock Category	**Animal Population**
Livestock population by category. Note: Only livestock categories for which manure management will be affected in some way by the AMMP projected should be included. Other livestock categories that are managed in other areas and for which manure management practices will not change may be excluded.	Lactating Dairy Cows (freestall)	1,500
	Cattle: dry cows	800
	Cattle: heifers (on feed)	400

Dairy Applicant Information	
Milk Fat (%)	4.10%
Milk true Protein (%)	3.20%
Milk Lactose (%)	4.50%
Milk Produced (lbs/cow/day)	55

Baseline Scenario: Applicants next enter data for the current practices under "Baseline manure management practices (current practices on the dairy or livestock operation)".

The applicant then identifies the predominant baseline manure collection practice (Flush), the average number of months livestock will spend at pasture (0), baseline solid separation practice (stationary screen), storage or treatment practice for separated solids (dry lot), and indicates if a flocculant is used to increase separation efficiency (No).

Finally, the applicant enters baseline electricity consumption (400 MWh/year) and diesel consumption (3,000 gallons/year).

Project Scenario: Just as with the baseline scenario, the applicant next enters information for the project scenario describing planned conditions and practices after conversion to a scrape system.

Note: For all projects, the livestock population is assumed to remain constant over the life of the project even if herd size may change.

The applicant then identifies the new practice to be adopted (4a - Scrape conversion with open solar drying), predominant manure collection system after project implementation (Partial scrape / partial flush / vacuum truck), the amount of manure that will continue to go to the flush system (25%), the average number of months livestock will spend at pasture (0), storage or treatment practice for separated solids (open solar drying), and the post-project solid separation practices (stationary screen). The field identifying the predominant storage or treatment practice after project implementation auto-populates based on the new practice to be adopted.

Finally, the applicant enters estimated electricity (250 MWh/year) and diesel fuel (3,500 gallons) use after project implementation.

	Baseline manure management practices (current practices on the dairy or livestock operation)	Manure management practices after implementation of proposed AMMP project
New practice to be adopted		4a - Scrape conversion with open solar drying
Manure collection system	Flush	Partial scrape / partial flush / vacuum truck
For partial scrape systems, enter the percentage of manure that is flushed on annual basis		25%
Number of months livestock spend at pasture (if any)	0	0
Primary Stage Solid Separation	stationary screen	stationary screen
Second Stage Solid Separation (if any)		
Storage/treatment practice for separated/scraped solids	dry lot	open solar drying
Is a flocculant used to increase separation efficiency?	No	No
Electricity consumption associated with manure management (MWh/year)	400	250
Diesel fuel consumption associated with manure management (gallons/year)	3,000	3,500

The final table is used to list relevant CO_2 emission sources located at the bottom of the screen. This is intended to be a descriptive list to provide supplemental information and is not used directly in the emissions calculations. In the AMMP Benefits Calculator Tool, diesel fuel use is reported as an aggregate number, but individual sources must still be listed at the bottom to identify what sources combusted each of the fuels identified. In this table, applicants also identify from a drop-down list whether each source is a new source (after adoption of alternative manure management practices), or whether there is expected to be an increase, decrease or no change in fuel consumption and GHG emissions as a result of the AMMP project.

Description of Stationary and Mobile Sources associated with Manure Management Activities included in GHG Emission Calculations

Source Description	Fuel Type	Change in emissions relative to Baseline
Manure collection and transport equipment	Diesel (Distillate No. 1 or 2, gal.)	Increase

Step 3: Estimate GHG Emission Reductions and Co-benefits Calculated using the AMMP Benefits Calculator Tool

After inputting all the required data, the applicant will click on the "GHG Summary" and "Co-benefits Summary" tabs of the worksheet. These tabs display the results calculated by the AMMP Benefits Calculator Tool.

The grey rows of the "GHG Summary" tab contain the metrics required to be reported by the project applicant to CDFA. In this example, the proposed project is expected reduce GHG emissions by 23,796 $MTCO_2e$ over five years. This also represents 0.03173 $MTCO_2e$ per dollar requested from AMMP. It also represents 0.34 $MTCO_2e$ reduction per metric ton of milk produced (energy corrected), and 8.81 $MTCO_2e$ reduction per animal in the project boundary.

Project Information		
Project Name		
Total AMMP GGRF Funds Requested or Awarded ($)	$	750,000
Other GGRF Leveraged Funds ($)	$	-
Non-GGRF Leveraged Funds ($)	$	-
Total Funds ($)	$	750,000

GHG Summary		
Total AMMP GHG Emission Reductions (MTCO2e)		23,796
Total GHG Emission Reductions ($MTCO_2e$)		23,796
Total GHG Emission Reductions per Total AMMP GGRF Funds (MTCO2e/$)	$	0.03173
Total GHG Emission Reductions per Total Funds ($MTCO_2e$/$)	$	0.03173
GHG reduction per unit energy-corrected milk over 5 years (GHG/ECM)		0.34
GHG reduction per animal over 5 years (GHG/animal)		8.81

The "Co-benefits Summary" tab contains additional supplemental information. This project is expected to increase local emissions of ROG, NO_x, $PM_{2.5}$ and diesel PM as a result of anticipated increase in diesel fuel consumption of 500 gallons per year. There are also some indirect decreases in ROG, NO_x, and $PM_{2.5}$ emissions resulting from decreased electricity use. The project is not expected to result in additional compost production. There is estimated to be a net energy and fuel cost savings resulting from decreased electricity consumption.

Criteria and toxic air pollutant emission reductions (lbs over 5 years)

	ROG	NO_x	$PM_{2.5}$	Diesel PM
local	-54.3	-413.3	-14.5	-15.8
remote	15.3	96.0	24.1	0.0
total	**-39.0**	**-317.3**	**9.6**	**-15.8**

Note: Positive values indicate emission reductons, while negative values indicate emission increases

Soil health co-benefits

Compost production	**0.0**	dry tons
Compost application area	**0.0**	Acres to be treated with compost soil ammendments

Note: Positive values indicate compost production, while negative values indicate reductions in compost production

Fossil fuel reductions (over 5 years)

Diesel gallons	**-2,500**

Note: Positive values indicate reductions in fossil fuel use, while negative values indicate increases in fossil fuel use

Fuel and energy cost savings (over 5 years)

$89,250

Example 4: Conversion from Flush to Aerated Vermifiltration System

Overview of the proposed project
The proposed AMMP project is requesting $750,000 dollars from CDFA to convert from a flush to aerated vermifiltration system. The characteristics of this project are:

- Located in Kern County;
- Current practice involves flush system and uncovered lagoon;
- There is no solid separation in the baseline scenario
    - Solids are stored outdoors to dry and periodically applied to land (dry lot);
- Proposed conversion to aerated vermifiltration system;
- $750,000 GGRF requested;
- 1,500 lactating dairy cows in freestalls, 800 dry cows, and 400 heifers (on feed);
- Average milk production of 55 lbs/cow/day, with 4.1% milk fat, 3.2% true protein, and 4.5% lactose;
- Diesel fuel used for manure collection and transport is expected to decrease from approx. 1,500 gallons/yr to 1,000 gallons/yr;
- 300 MWh electricity consumption in baseline scenario is expected to decrease to 250 MWh.

Methods to apply

Step 1: Identify the Project Boundary

The first step in quantifying this example project is to determine the Project Boundary. In order to do this, applicants should review included sources in Table 1 as it relates to their dairy or livestock operations. Applicants must be sure to identify any combustion sources associated with manure management operations prior to the adoption of new practices, identify how these emissions are expected to change as a result of the project, and identify if the project includes any new fossil-fuel combustion sources.

Methane emissions from manure volatile solids as well as CO_2 emissions associated with manure management support equipment and vehicles (both direct emissions from onsite combustion of fossil fuels and indirect emissions from electricity consumption) all fall within the project boundary both in the baseline and project scenarios.

In this example, there are diesel emissions associated with the collection of manure and support equipment; the quantity of diesel fuel combusted is expected to increase as a result of scrape system equipment and manure transport. Electricity use is expected to decrease as a result of decreased pumping for flush water.

Step 2: Determine the AMMP Calculator Tool Inputs Needed

Step 2 of this Quantification Methodology requires applicants to enter project-specific information into the AMMP Calculator Tool. First, download and open the Calculator Tool from www.arb.ca.gov/cci-resources. The applicant begins by reading the "Read Me" and

"Definitions" tab. Next, the applicant clicks on the "Project Info" and "Project Data Inputs" tab and enters required project information.

Below are a series of screenshots of the "Project Data Inputs" tab of the AMMP Calculator Tool. The fields highlighted green are required for all projects, while the fields highlighted blue may apply to some projects. Where input fields do not apply to the applicant's project, they may be left blank or a "0" value may be input.

For this example, applicants select "Kern" for the project location. Applicants then select "lactating dairy cows (freestalls)", "Cattle: dry cows", and "Cattle: heifers (on feed)" and 1,500, 800, and 400, respectively, for animal population. Animal populations should be determined based on the average of the preceding 12 months.

Since the project includes lactating dairy cows, the applicant enters information regarding milk production (Average milk production of 55 lbs/cow/day, with 4.1% milk fat, 3.2% true protein, and 4.5% lactose).

Project location (county)	Kern

	Livestock Category	Animal Population
Livestock population by category. Note: Only livestock categories for which manure management will be affected in some way by the AMMP projected should be included. Other livestock categories that are managed in other areas and for which manure management practices will not change may be excluded.	Lactating Dairy Cows (freestall)	1,500
	Cattle: dry cows	800
	Cattle: heifers (on feed)	400

Dairy Applicant Information	
Milk Fat (%)	4.10%
Milk true Protein (%)	3.20%
Milk Lactose (%)	4.50%
Milk Produced (lbs/cow/day)	55

Baseline Scenario: Applicants next enter data for the current practices under "Baseline manure management practices (current practices on the dairy or livestock operation)".

The applicant then identifies the predominant baseline manure collection practice (Flush), the average number of months livestock will spend at pasture (0), baseline solid separation practice (none), storage or treatment practice for separated solids (dry lot), and indicates if a flocculant is used to increase separation efficiency (No).

Finally, the applicant enters baseline electricity consumption (300 MWh/year) and diesel consumption (1,500 gallons/year).

Project Scenario: Just as with the baseline scenario, the applicant next enters information for the project scenario describing planned conditions and practices after conversion to a scrape system.

Note: For all projects, the livestock population is assumed to remain constant over the life of the project even if herd size may change.

The applicant then identifies the new practice to be adopted (3h – Solid separation with aerated vermifiltration system), predominant manure collection system after project implementation (Aerated vermifiltration system), the average number of months livestock will

spend at pasture (0), and the post-project solid separation practices (stationary screen). The field identifying the predominant storage or treatment practice after project implementation auto-populates based on the new practice to be adopted.

Finally, the applicant enters estimated electricity (250 MWh/year) and diesel fuel (1,000 gallons) use after project implementation.

	Baseline manure management practices (current practices on the dairy or livestock operation)	Manure management practices after implementation of proposed AMMP project
New practice to be adopted		3h - Solid separation with aerated vermifiltration system
Manure collection system	Flush	Aerated vermifiltration system
For partial scrape systems, enter the percentage of manure that is flushed on annual basis		
Number of months livestock spend at pasture (if any)	0	0
Primary Stage Solid Separation	none	stationary screen
Second Stage Solid Separation (if any)		
Storage/treatment practice for separated/scraped solids	dry lot	aerated vermifiltration
Is a flocculant used to increase separation efficiency?	No	No
Electricity consumption associated with manure management (MWh/year)	300	250
Diesel fuel consumption associated with manure management (gallons/year)	1,500	1,000

The final table is used to list relevant CO_2 emission sources located at the bottom of the screen. This is intended to be a descriptive list to provide supplemental information and is not used directly in the emissions calculations. In the AMMP Benefits Calculator Tool, diesel fuel use is reported as an aggregate number, but individual sources must still be listed at the bottom to identify what sources combusted each of the fuels identified. In this table, applicants also identify from a drop-down list whether each source is a new source (after adoption of alternative manure management practices), or whether there is expected to be an increase, decrease or no change in fuel consumption and GHG emissions as a result of the AMMP project.

Description of Stationary and Mobile Sources associated with Manure Management Activities included in GHG Emission Calculations		
Source Description	Fuel Type	Change in emissions relative to Baseline
Manure collection and transport equipment	Diesel (Distillate No. 1 or 2, gal.)	Decrease

Step 3: Estimate GHG Emission Reductions and Co-benefits Calculated using the AMMP Benefits Calculator Tool

After inputting all the required data, the applicant will click on the "GHG Summary" and "Co-benefits Summary" tabs of the worksheet. These tabs display the results calculated by the AMMP Benefits Calculator Tool.

The grey rows of the "GHG Summary" tab contain the metrics required to be reported by the project applicant to CDFA. In this example, the proposed project is expected reduce GHG emissions by 45,777 $MTCO_2e$ over five years. This also represents 0.06104 $MTCO_2e$ per dollar requested from AMMP. It also represents 0.66 $MTCO_2e$ reduction per metric ton of milk

produced (energy corrected), and 16.95 $MTCO_2e$ reduction per animal in the project boundary.

Project Information		
Project Name		
Total AMMP GGRF Funds Requested or Awarded ($)	$	750,000
Other GGRF Leveraged Funds ($)	$	-
Non-GGRF Leveraged Funds ($)	$	-
Total Funds ($)	$	750,000

GHG Summary		
Total AMMP GHG Emission Reductions (MTCO2e)		45,777
Total GHG Emission Reductions ($MTCO_2e$)		45,777
Total GHG Emission Reductions per Total AMMP GGRF Funds (MTCO2e/$)	$	0.06104
Total GHG Emission Reductions per Total Funds ($MTCO_2e$/$)	$	0.06104
GHG reduction per unit energy-corrected milk over 5 years (GHG/ECM)		0.66
GHG reduction per animal over 5 years (GHG/animal)		16.95

The "Co-benefits Summary" tab contains additional supplemental information. This project is expected to decrease local emissions of ROG, NO_x, $PM_{2.5}$ and diesel PM as a result of anticipated decrease in diesel fuel consumption of 500 gallons per year. There are also some indirect decreases in ROG, NO_x, and $PM_{2.5}$ emissions resulting from decreased electricity use. The project is not expected to result in additional compost production. There is estimated to be a net energy and fuel cost savings resulting from decreased fuel and electricity consumption.

Criteria and toxic air pollutant emission reductions (lbs over 5 years)

	ROG	NO_x	$PM_{2.5}$	Diesel PM
local	54.3	413.3	14.5	15.8
remote	5.1	32.0	8.0	0.0
total	**59.4**	**445.3**	**22.5**	**15.8**

Note: Positive values indicate emission reductons, while negative values indicate emission increases

Soil health co-benefits

Compost production	**0.0**	dry tons
Compost application area	**0.0**	Acres to be treated with compost soil ammendments

Note: Positive values indicate compost production, while negative values indicate reductions in compost production

Fossil fuel reductions (over 5 years)

Diesel gallons	**2,500**

Note: Positive values indicate reductions in fossil fuel use, while negative values indicate increases in fossil fuel use

Fuel and energy cost savings (over 5 years)

$42,550